

INTERNATIONAL SEARCH REPORT

International Application No  
PCT/JP 03/12973

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H01M8/04

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**  
Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
EPO-Internal, PAJ, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 07, 3 July 2002 (2002-07-03) & JP 2002 093438 A (HONDA MOTOR CO LTD), 29 March 2002 (2002-03-29) abstract; figure 1 -----	1,2,17, 20-22
X	EP 0 269 877 A (UNITED TECHNOLOGIES CORP) 8 June 1988 (1988-06-08)	1,20
Y	column 3, line 13 - column 5, line 41; figure 1	1,2,17, 20-22
Y	-----	21-23
Y	US 2002/136942 A1 (KASHIWAGI NAOTO) 26 September 2002 (2002-09-26) paragraph [0025] - paragraph [0052]; figures 1,2,5,7 -----	21-23
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Further documents are listed in the continuation of box C.  Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier document but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  19 August 2004	Date of mailing of the international search report  25.11.04
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  Thanos, I
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## INTERNATIONAL SEARCH REPORT

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 40 05 468 A (LINDE AG) 22 August 1991 (1991-08-22)	1,20,21
Y	column 3, line 54 - column 4, line 36; figure 1	3,8,11, 12,17
Y	----- US 2002/119361 A1 (HERRMANN MANFRED) 29 August 2002 (2002-08-29) paragraph [0016] - paragraph [0022]; figure 1	3,8,11, 12,17
Y	----- US 2002/053469 A1 (MATSUDA YOSHINARI) 9 May 2002 (2002-05-09) paragraph [0071] - paragraph [0072]; figure 1	1-3, 20-23
X	----- US 5 059 494 A (LANDAU MICHAEL B ET AL) 22 October 1991 (1991-10-22)	22
Y	column 2, line 17 - column 4, line 7; claim 3; figures 1,2	1-3, 20-23
Y	----- DE 100 45 880 A (XCELLSIS GMBH) 19 September 2002 (2002-09-19) column 1, line 1 - column 3, line 67; figure 3	1-3, 20-23
A	----- PATENT ABSTRACTS OF JAPAN vol. 0122, no. 21 (E-625), 23 June 1988 (1988-06-23) & JP 63 016571 A (HITACHI LTD), 23 January 1988 (1988-01-23) abstract; figure 1 -----	1,20,21

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## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1,2,3,8,11,12,17,20,21-23

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

## 1. claims: 1,2,3,8,11,12,17,20,21-23

This invention concerns a fuel cell system comprising a fuel cell, a hydrogen supply source, a hydrogen recirculation, a hydrogen ejector disposed between hydrogen source and fuel cell apt to eject recycled hydrogen into the feed line and a shut-off mechanism for the ejector, wherein the special technical feature resides in providing more than three ejectors with at least one selective shut-off mechanism for individual control of at least one ejector. The same invention concerns respective methods of controlling hydrogen feed and hydrogen recirculation of a fuel cell system.

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## 2. claims: 4,6,13,15

This invention concerns a fuel cell system comprising a fuel cell, a hydrogen supply source, a hydrogen recirculation, a hydrogen ejector disposed between hydrogen source and fuel cell apt to eject recycled hydrogen into the feed line and a shut-off mechanism for the ejector, whereby a plurality of ejectors, in particular more than three ejectors with at least one selectively operating shut-off mechanism are incorporated in the fuel cell system. The special technical feature of this invention resides in the particular type of ejector system used, which comprises a cylindrical valve body which can be moved rotationally in order to bring various ejectors into fluid communication with the hydrogen inlet port.

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## 3. claims: 5,14

This invention concerns a fuel cell system comprising a fuel cell, a hydrogen supply source, a hydrogen recirculation, a hydrogen ejector disposed between hydrogen source and fuel cell apt to eject recycled hydrogen into the feed line and a shut-off mechanism for the ejector, whereby a plurality of ejectors, in particular more than three ejectors with at least one selectively operating shut-off mechanism are incorporated in the fuel cell system. The special technical feature of this invention resides in the particular type of ejector system used, which comprises a spherical valve body which can be moved rotationally in order to bring various ejectors into fluid communication with the hydrogen inlet port.

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## 4. claims: 7,16

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This invention concerns a fuel cell system comprising a fuel cell, a hydrogen supply source, a hydrogen recirculation, a hydrogen ejector disposed between hydrogen source and fuel cell apt to eject recycled hydrogen into the feed line and a shut-off mechanism for the ejector, whereby a plurality of ejectors, in particular more than three ejectors with at least one selectively operating shut-off mechanism are incorporated in the fuel cell system. The special technical feature of this invention resides in the particular type of ejector system used, according to which a plurality of ejectors operate with a common diffuser, irrespective of structural details of the ejector and valve bodies concerning inventions 1-3.

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5. claims: 9,10,18,19

This invention concerns a fuel cell system comprising a fuel cell, a hydrogen supply source, a hydrogen recirculation, a hydrogen ejector disposed between hydrogen source and fuel cell apt to eject recycled hydrogen into the feed line and a shut-off mechanism for the ejector, whereby a plurality of ejectors, in particular more than three ejectors with at least one selectively operating shut-off mechanism are incorporated in the fuel cell system. The special technical feature of this invention resides in the particular positions of stationary and moving elements of the ejectors in which sealing materials are disposed irrespective of the particular shape characteristics of the valve components of such ejectors.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2002093438	A	29-03-2002	NONE
EP 0269877	A	08-06-1988	US 4766044 A 23-08-1988 CA 1289617 C 24-09-1991 DE 3777969 D1 07-05-1992 DE 269877 T1 20-04-1989 EP 0269877 A1 08-06-1988 ES 2031105 T3 01-12-1992 JP 1086457 A 31-03-1989
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US 5059494	A	22-10-1991	JP 2660097 B2 08-10-1997 JP 5501174 T 04-03-1993 WO 9117578 A1 14-11-1991
DE 10045880	A	19-09-2002	DE 10045880 A1 19-09-2002
JP 63016571	A	23-01-1988	JP 2108534 C 21-11-1996 JP 8001808 B 10-01-1996